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Entomology with the U.S. Marines in Vietnam— Some Lessons Learned

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The following is a discussion of the entomology-related activities of the 1st Marine Division in the Republic of Vietnam during 1968. It is based on the author's experiences as the first medical entomologist to be assigned to the Division's Preventive Medicine Section since its deployment to Vietnam in 1964.

The 1st Marine Division's area of responsibility during 1968 was in the I Corps Tactical Zone, the northernmost corps area in Vietnam. The majority of the troops were concentrated from Hue to about 25 miles south of Danang. The area was primarily coastal and foothill terrain consisting largely of rice paddies interspersed with estuaries, rivers and small farms. Units were also deployed to mountainous areas (medium elevation and rivers) near the Demilitarized Zone (DMZ). Potential disease vectors, particularly mosquitoes, were found in abundance in certain of these areas, and malaria, dengue, encephalitis, plague, scrub typhus and filariasis represented a potential threat to combat readiness and effectiveness.

While disease vector control was of utmost importance, control measures were often frustrated by the inaccessible location of vector breeding sources and the very nature of the war. The latter includes the effects of the so-called Tet Offensive, a series of surprise attacks by the Viet Cong (VC) and the North Vietnamese Regular Army (NVA) beginning 31 January 1968. Under orders to "crack the sky and shake the earth," the offensive consisted of three phases, the last of which ended on 23

September 1968. Of the over 58,000 troops killed in action (KIA) during the Vietnam war, almost 30% occurred during 1968. The difficulties working in areas of high disease incidence were made all the more challenging by this significant increase in combat intensity.

Preventive Medicine Section

The Preventive Medicine Section (PMS) was a general support element responsible to the Commanding General for supervising the preventive medicine program of the 1st Marine division. The PMS was located in Danang under the technical control of the Division Surgeon. It received its administrative and logistical support from the 1st Medical Battalion.

The primary focus of the PMS was directed toward the more complex health problems beyond the technical capability of individual commands. This included the provision of epidemiological, laboratory and entomological services, assisting in the detection and elimination of direct and potential health hazards and providing training and indoctrination of personnel in the principles and practices of field preventive medicine.

The Table of Organization (T.O.) for PMS staff included one environmental Health Officer as OIC, one assistant OIC, three Environmental Sanitation Officers, one Medical Entomologist, 15 Preventive Medicine Technicians (PMT's) and three Laboratory Technicians. Several staff, including the entomologist, were frequently

temporarily assigned duty (TAD) to forward PMS detachments in Phu Bai and An Hoa.

Working for the Division Surgeon but receiving logistical and administrative support from the Company Medical Battalion (CO MedBN) was a challenge at times. The PMS operated without assigned vehicles and drivers for the first eight months of the year until these assets were assigned directly to the PMS. Essentially, the staff had to “thumb rides” to outlying units using already overtaxed ground and air assets. This was often unacceptable when trying to respond to the urgent needs of outlying commands. PMS personnel were continually “borrowed” to stand watch and perform other non-related functions. Much of this was related to a lack understanding and appreciation of the PMS’s mission.

Entomology Branch

An Entomology Branch of the PMS was organized and staffed with the entomologist and four enlisted Preventive Medicine Technicians who were responsible for vector surveillance, vector control, rodent control, and epidemiology. A laboratory was established for the identification of disease vectors, particularly mosquitoes.

Initial inspections revealed that vector control in 1st Division units was largely inadequate due to a general lack of equipment, supplies, and trained personnel. Most unit corpsmen were found using 5-20% DDT for all of their vector and pest problems, few had a working knowledge of proper control techniques, and many did not have adequate equipment to accomplish control. To correct these conditions: (1) a training course was established to train corpsmen from each marine unit in the fundamentals of vector control; (2)

entomological surveys were made regularly to determine potentially active problem areas and make recommendations for their control or elimination; (3) control operations were accomplished when necessary; (4) handouts on vector control, malaria and malaria discipline were written and distributed to all units; and (5) assistance was rendered to all commands in the acquisition of proper equipment and supplies as needed.

Vector-Borne Diseases

Malaria. Malaria was the most important vector-borne disease found in Vietnam. Approximately 1,200 cases of malaria were reported for the 1st Marine Division during 1968, representing about 25,000 days of hospitalization. Of that total, about 60% were falciparum malaria, 22% were vivax malaria, < 1% were malariae malaria, 5% were mixed infections, and 13% were undetermined infections.

Locations in I Corps with the highest malaria incidence rates were the interior highlands, including Khe Sanh and Ca Lu (April through July), and An Hoa (July through November). The Happy Valley, Elephant Valley, and Antenna Valley areas were secondary sources throughout the year. Relatively few cases occurred in the cities, coastal plains or foothill areas such as Danang, Phu Bai, and Chu Lai.

Malaria contracted by military personnel was probably acquired outdoors rather than indoors, primarily from the exophilic species *Anopheles aconitus*, *An. maculatus*, *An. jeyporiensis candidiensis* and, in some areas, *An. balabacensis*. Secondly it may have been acquired from *An. minimus*, and *An. sinensis*, the most common *Anopheles* found in Vietnam.

The endemicity of malaria varied widely in time and space. This was probably due to the large, mobile parasite reservoir (NVA, VC & local populations), occurrence of drug-resistant falciparum malaria, the lack of complete information on the population at risk and degree of risk in specific areas, and factors that influenced mosquito abundance (e.g., breeding sources, available harborages, flight ranges).

Fevers of Undetermined Origin (FUO's) and Dengue. Military medical personnel had a general lack of knowledge and experience with infectious diseases in the area and their manifestations in non-immune adults. As a result, the clinical diagnosis of FUO's was a major problem confronting physicians serving in Vietnam. The vectors of dengue, *Aedes aegypti* and *Ae. albopictus*, were commonly found in the area, and many FUO's may have been a mild form of dengue. In any case, the true incidence of the disease was unknown at the time.

Japanese B Encephalitis. Less than 40 1st Division personnel were diagnosed with a Group B arbovirus infection through hemagglutination-inhibition tests. Depending on the clinical picture, some of these were most likely Japanese B and the others probably due to one of the dengue viruses. The vectors *Culex tritaeniorhynchus*, *C. gelidus* and *C. pipiens-quinquefasciatus* were commonly encountered in larval and adult surveys in the Phu Bai, An Hoa, and Danang areas. Light trap collections of the first two species were heaviest during the months of July through November in Danang.

Filariasis, Scrub Typhus & Plague. Filariasis and plague occur in Vietnam,

but the actual incidence rate in US Marine personnel during 1968, if any, was not available at the time. About 22 cases of scrub typhus occurred in 1st Division units from the Hoi An and An Hoa areas.

Mosquito Surveillance

A primary function of the Entomology Branch was mosquito surveillance. This proved to be a frustrating experience in many ways. Surveys could be accomplished with relatively little difficulty in base camp areas, which were usually at low risk for malaria. In highly malarious regions, such as the foothills and mountains, these activities were often impossible for security reasons and inaccessibility.

Larval Surveillance. Larval surveys were conducted at all units in the Danang, Phu Bai, Gia Le, Chu Lai, and An Hoa areas in order to identify and eliminate breeding sites in or near the cantonments. Pre-surveys and post-surveys were made in conjunction with ground and aerial spray missions, and additional surveys were conducted throughout the countryside to obtain biological data and to build up a reference collection.

Adult Surveillance. Adult surveillance utilizing mosquito light traps was conducted throughout the year in the Danang area and for part of the year in the Phu Bai and An Hoa areas. Populations were high during the periods prior to and following the monsoon season, and low during the monsoon months and some of the hot, dry summer months. Similar indices would probably be found in the foothill and mountain regions. The location of light traps was often a challenge. Their use in the "bush" was not feasible for security reasons, lack of power sources, and the

possibility of being booby-trapped. Even in relatively secure base camp areas, they could seldom be hung in the most ideal location because the white light could act as a “beacon” to the enemy. Vandalism was often encountered, and one trap was rendered inoperative by a 122 mm rocket.

Day and night mosquito-bite counts were conducted when 1st Division troops moved into new areas such as Phu Bai and An Hoa. Bite counts were useful for obtaining data about the biting habits of important species and determining if any primary vectors were prevalent in an area. They could only occasionally be conducted at units located in very hostile areas because there was seldom any way to effect control, and the risks involved were difficult to justify. During one night at An Hoa, bite counts were suspended after the use of a red-lens flashlight still provoked enemy fire. On another occasion, an all-night bite count was conducted at the Liberty Bridge combat base. The mosquito populations were so high that only the lower part of one leg could be exposed in order to keep up with the numbers biting.

Surveys conducted in the countryside were especially enjoyable due to the interest and participation of the villagers—particularly the Vietnamese children. Whether mosquitoes, leeches or general insects were being collected, the kids were always eager to help. They became very adept at handling a dipper or collecting net and, at times, outdid the professionals. Cards printed in Vietnamese were carried that explained what was being done and why.

Mosquito Control

Mosquito control in 1st Marine Division units consisted essentially of attempts to control the secondary vectors

of malaria, the vectors of dengue and encephalitis, and pest mosquitoes in relatively secure base camp areas. The major malaria and mosquito problems were associated with observation posts, Combined Action Program (CAP) units, night patrols, and larger units operating in the foothills and mountain regions. These areas were usually too insecure or too inaccessible for ground equipment, and no aerial dispersal systems were available that could be flown in such a manner as to avoid hostile fire.

Ground Control. In base camp areas, breeding was usually limited to artificial containers during the summer months and to small areas of standing water during the winter months. Fire barrels were frequent offenders, and recommendations included screening or covering and the addition of diesel fuel. Attempts were made to eliminate artificial containers, such as C-ration cans, shell casings, clay pots, unused fighting holes and bunkers, barrel rim tops and tires, all of which commonly contained breeding mosquitoes. Areas with standing water within or adjacent to camps were drained or filled. If source reduction was not possible, then the areas were usually treated with 2% Fenthion granules applied with back-pack mister-dusters.

Based on light trap counts and complaint calls, adulticiding operations with trailer-mounted, military cold foggers were conducted at all units accessible by road. Hand compressed sprayers, back-packs and buffalo turbines were used for making residual applications of malathion to bunkers, hootches, and vegetation where resting mosquitoes were found. Pyrethrum aerosol dispensers were recommended for space treatments inside bed nets,

tents and buildings at night to eliminate resting adults.

Aerial Dispersal. During the year, the U. S. Air Force Special Aerial Spray Flight Team (Ranch Hands) operated one C-123 aircraft for the aerial dispersal of insecticide for all of South Vietnam. Through coordination with the Preventive Medicine Unit, Naval Support Activity (PMU, NSA), about one flight each month was flown in the Danang and Phu Bai areas. Low-volume dispersal of 57% or 95% malathion was used. Light trap counts in treated areas usually dropped by 60 to 80 percent and remained so for 5-10 days. The use of a low-flying C-123 over insecure territory was considered an unacceptable risk, and requests for missions in such areas were never approved.

GRANDAP units developed by the Navy Disease Vector Control Center (DVCC) in Jacksonville, Florida, were operated by the PMU (NSA) in HU-34 helicopters. These were deployed on four occasions in the Hue-Phu Bai area, dispersing a total of 14,000 pounds of 2% Fenthion granules for larviciding effect. Adequate coverage was seldom achieved due to the difficulty in getting pilots to treat the breeding sites thoroughly and equipment malfunctions. Because of the vulnerability of low-flying aircraft to hostile fire, no missions were flown in insecure areas of the 1st Division.

During November, a commercial aerial dispersal unit called the HUSS (Helicopter Underslung Spray System) was evaluated in the Danang area. The HUSS was a self-contained unit that operated from a pendant attached to a helicopter. Mechanical problems were encountered and there were difficulties in obtaining aircraft and pilots to fly the spray missions. In one instance, the pilot

“accidentally” hit the quick release button and the unit detached, falling 150 feet into the South China Sea.

Aerial dispersal by helicopter was useful for controlling vectors and pest mosquitoes in secure base camp areas. However, it was not the answer to the problems encountered in hyperendemic areas, where vulnerability to enemy fire prevented rotary-winged aircraft from flying grid-pattern swath widths in the "small arms envelope" of 0-1500 feet. Small payload and poor availability of helicopters limited regular applications needed to effect control. In addition, the assignment of adequate helicopter pilots, technical direction and crews was seldom possible because of the demands of combat operations.

Malaria Discipline

The difficulties in eliminating vectors in highly malarious areas, the mobile and often rapid pace of military operations, and the realities of tactical and logistical limitations underscored the importance of individual Marines protecting themselves. This included the use of personal protective measures, such as chemoprophylaxis, insect repellents, bed nets and protective clothing. Unfortunately, these measures were not always employed to maximum effectiveness.

The utilization of personal protective measures or "malaria discipline" was monitored in the 1st Division by making regular malaria discipline surveys at all units and conducting nearly 1,000 interviews on malaria and non-malaria patients. The results of the interviews revealed serious deficiencies, including the failure to take chemoprophylaxis and apply repellents regularly and correctly.

Command support. Consistent and vigorous command emphasis on

preventive measures is critical to a malaria discipline program. Messages prepared by the OIC, PMS, were distributed through the Commanding General as needed. They stressed the CG's concern regarding the high incidence rates and directed that steps would be taken to improve malaria discipline at all levels. Such support proved invaluable when dealing with some commands.

Chemoprophylaxis. Based on interviews of 674 malaria patients, 16% complained about the non-availability of suppressive drugs and 21% complained of adverse side effects. About 60% admitted not taking the C-P tablet regularly during their tour, usually missing more than once and some for six months or longer. Patients were, of course, reluctant to admit any laxity in their chemoprophylaxis.

The reasons given for not taking the tablet were varied and at times amusing. Some said they simply forgot or it was not available. Others complained of adverse side effects such as diarrhea, headaches, stomach cramps, nausea or dizziness. One individual complained that the pill made him burp for several hours after ingestion. A few insisted that the pills actually gave them malaria.

The administration of the tablet was a problem at some units. At base camps, roster systems with follow-ups of absentees were established. But it was the troops in the field that most often missed taking the tablet.

Recommendations were made that the unit corpsman be responsible for carrying an adequate supply, dispensing them to the men in their unit and ensuring that they swallowed the pill.

It was difficult to determine what percentage of patients contracted falciparum malaria because of a laxity in

chemoprophylaxis or because of the presence of drug resistance. At the time, it was generally believed that the C-P tablet was 60% to 80% effective against falciparum strains and 100% effective against vivax malaria (except in cases of high parasitemias).

Repellent. Based on interviews with 674 malaria patients, 22% said repellent was not available, 49% did not use repellent regularly or properly, and 21% disliked the standard issue repellent for a number of reasons. Non-availability of repellent was a problem at times; however, the lack of repellent was not the primary reason for the failure to use it regularly. Even when an adequate supply was available, it was usually applied when pest mosquitoes were abundant in the early evening hours and was not reapplied during the night when *Anopheles* mosquitoes were active (particularly after 2000 hours). Even when used regularly, most individuals failed to apply it to areas where clothing fits tight against the skin, enabling mosquitoes to bite through the layers.

A small percentage would not use repellent, believing, falsely, that the Viet Cong could detect the odor. A few stated that they seldom used it because mosquitoes never bothered them or that they were "too tough" to need protection. Some disliked it because it caused burns or skin irritations or because it "smelled bad," left an oily sensation on the skin or "didn't taste good." Repellent purchased through local exchanges was believed to be significantly better than the standard military issue. About 60% of the Marines interviewed were unaware that using repellents could protect them from dengue, encephalitis and filariasis.

Bed Nets. In base camp areas where pest mosquitoes were abundant and

annoying, bed nets were in general use. In the field, where protection from *Anopheles* bites was vital, bed net use was seldom feasible because of the combat situation. Even in base camps, many complaints were received that the nets were too hot and impeded quick retreat to bunkers during a mortar or rocket attack.

Protective Clothing. During the extremely hot, humid summer months, it often seemed unrealistic to expect troops in the field to always keep their sleeves rolled down, blouses buttoned and trousers bloused during the hours after dusk or when entering dark jungle areas. In many cases, minimal clothing was being worn anyway and PMS emphasized covering all exposed areas with repellent and wearing as much protective cloth as feasible.

Malaria Discipline Lectures. It was soon obvious from the malaria interviews and discussions with troops in the field that a great deal of ignorance existed concerning malaria as a disease and its prevention. Many had little or no idea of how the disease was contracted, and some actually believed it was from drinking "bad" rice paddy water. One malaria patient insisted that he had never been bitten by mosquitoes but noted that "I was bitten by a snake once." Clearly, guidance was needed to help separate fact from fiction.

Most Marines received some level of malaria discipline training in the United States before coming to Vietnam; however, less than 40% received such indoctrination while in the country. To establish a better educational program, a field guide on malaria and malaria discipline was developed and distributed to all commands, and assistance was given in establishing malaria discipline programs. Monthly malaria discipline

visits were made at all units to help promote the continuation of these programs.

Malaria Reporting. While visiting outlying units experiencing high incidence rates of malaria, it was discovered that little or no feed-back was being received regarding the actual number of cases they had each month. Most also had little idea of the real status of their malaria discipline programs. Battalion and Regimental Surgeons frequently complained that recommendations to their commanding officers for reducing malaria rates were often poorly received because they had no data "on paper" to back them up. Beginning in June, a monthly report was sent by the PMS through the Division Surgeon to each Regiment and Separate Battalions. The reports listed the number of cases that occurred in the unit along with a discussion of their weak areas in malaria discipline (based on malaria interviews).

Significant Pests

During the year, 233 pest control operations were conducted at outlying units on request. Of that total, 39% were for filth flies, 19% for mosquitoes, 16% for rodents, 14% for cockroaches, 8% for ants, 3% for termites, and 1% for stored product pests. Because of transportation problems, even the simplest of these operations often required a half day or longer to accomplish. In addition, many units became completely reliant on the PMS and would not make even basic corrections of discrepancies themselves. The PMS was not designed as an on-call pest control company, but it endeavored to help individual units handling their own routine problems when trained

personnel and appropriate supplies were aboard to do so.

Filth Flies. Infestations of filth flies were the most common problem encountered at the typical mess hall. The primary nuisance was the ubiquitous House Fly (*Musca domestica*); the Old World Secondary Screwworm (*Chrysomia megacephala*) was a secondary pest. The control of flies in Vietnam was complicated because much of the breeding came from nearby villages where flies had easy access to animal feces and garbage. This was true also of Vietnamese dumps, which were poorly operated and maintained.

While the greatest percentage of flies found inside a mess hall could be excluded by good screening and close-fitting doors, the exclusion of flies was a constant battle. Part of the problem was due to the temporary nature of the buildings, heavy usage, exposure to extremes in weather, and occasional 122 mm rockets. Typically, screening was torn or rotten and needed to be replaced, doors were ill-fitting and often propped open during the day, and entrance holes in the bulkheads and overheads needed patching. Correction of these discrepancies was the obvious solution to the problem. It was not so obvious to some commanders who instead insisted that the areas should be sprayed once a day and were, in some cases, requiring their personnel to do so.

Initial inspections at outlying units revealed that many were using, or had on hand, a variety of unauthorized concentrated pesticides. During the year, over 350 gallons of concentrated malathion, chlordane, dieldrin, DDT and lindane were confiscated. At one motor pool, for example, several gallons of 57% malathion were discovered. Upon inquiry, a staff sergeant replied that they

had run out of engine oil and were using "that other stuff" instead.

As needed, residual treatments with 0.5% Diazinon were applied to areas where flies were found resting. Dry baits and fly cords were tried, but a water bait gave better results. The technique consisted of cutting sponges to fit a specimen cup containing a solution made by mixing 3 ounces of DDVP and 3 pounds of sugar in 1 gallon of water. When placed in strategic locations, it was not uncommon to find the cups covered with dead flies within a few hours.

Breeding within the cantonments was usually located in burn-out barrels and effluent from the galley. In this modern conflict, the old-style military head (sitting over a pit) was improved by placing one half of a 55-gallon barrel filled with 3 inches of diesel oil under each hole. Every morning, these were removed, additional fuel added, and the fecal matter burned off. If the contents were not adequately burned or, worse yet, not burned at all, the resulting fly breeding was intolerable. Additional problems were created when barrels leaked on the deck or ground or when someone neglected to replace barrels that had been removed. Unfortunately, Marines did not always look before they sat.

Ideally, effluent from the galley should be disposed of by piping it through a grease trap and into a soakage pit or leaching field. Grease traps often failed and had to be replaced because they were designed to last only six months. During heavy rains, drainage systems commonly backed up and flooded the area with organic matter. In some cases, soakage pits were not utilized and the effluent was simply piped directly to the perimeter.

Regardless of the source of the problem, whenever effluent soaked into the soil it became an excellent breeding source for filth flies.

Other problems included the storing of wastes in garbage cans without lids (even though lids were often stacked neatly nearby), rusting cans sitting directly on the ground where organic matter leaked into the soil, or the garbage not being collected often enough.

Garbage at most cantonments was collected by the Vietnamese. Units in the bush, however, did not have this service and had to dispose of their own. Sanitary landfills were the basic recommendation in these cases. Due to the lack of proper equipment and a reticence by some commands to designate personnel to be responsible for the landfills, few units ever achieved a completely satisfactory method of waste disposal.

At one combat base, the fly infestation was so heavy that it was difficult to eat in the mess hall without ingesting one or two. Not only was garbage scattered throughout the dump site but raw feces were also being dumped in the area. When space treatment was accomplished using Dyna-Fog 70 units, the operators literally became black with flies as horrendous numbers were stirred up by the fog. Foggers were loaned to outlying units with serious fly or mosquito problems. This practice was eventually discontinued because the foggers were abused in most cases and two were permanently damaged. One was even returned with the insecticide tank filled with white enamel paint.

Graves Registration. An unpleasant but indispensable job of the PMS was the treatment of bodies at Graves Registration after they had been exposed

in the field for several days. In advanced stages of decomposition, they were often heavily infested with fly larvae and carrion beetles. The most effective method of treatment was the application of 1/3 gallon of 0.5% DDVP in water to each body bag. The Vapona effected rapid kill and, due to its short residual life, left little danger of contamination after 24 hours.

Rodents. Several species of rats and mice are found in Vietnam. The Roof Rat (*Rattus rattus*) was the most common species but the Norway rat (*Rattus norvegicus*) was prevalent in the port cities. During the year, 757 rodents were trapped by the PMS or received from outlying units for disposition. Of the total, 39% were Norway Rats, 42% were Roof Rats, 8% were Polynesian Rats (*Rattus exulans*) and the remainder (11%) were mice (*Mus musculus*), shrews (*Tupaia* spp.), mongoose (*Herpestes* spp.) and Bandicoot Rats (*Bandicota indica*).

Most cantonments experienced rodent problems but they were seldom of major importance except in rat bite cases (which necessitated an individual taking 14-21 of the painful rabies shots). Recommendations for control included the elimination of all unnecessary food and harborages available to rodents and the institution of trapping and poisoning programs.

Snap or break-back traps were never as profitable as live traps. Some of the larger rats were able to survive and escape snap traps, so they were seldom used. Live trapping was also preferred because it afforded the opportunity to establish ectoparasite indices. (Live traps were available on the local market for 50 cents each). For bait, peanut butter or sardines wrapped in a 2x2 gauze square consistently gave good results. On

occasion, two and even three rats were caught at the same time.

Unique problems were associated with trapping. Traps were often stolen or trampled, or the animal was released. Some Marines poured lighter fluid or DEET repellent on the trapped animal, applied a match, and then released the burning victim to watch it run off. In one instance, a near catastrophe occurred when the blazing creature ran into an ammunition bunker.

The use of anticoagulant baits was not particularly successful. The dry rolled oats carrier was probably a poor competitor against other readily available foods (particularly for the 5-7 consecutive days required for the animal to obtain a lethal dose). In cases of heavy rat infestations, poison bait torpedoes of zinc phosphide, hamburger, corn meal and salad oil or zinc phosphide and peanut butter were made up and dispensed. Generally 60-90% of the bait was taken and good control obtained. Cards printed in Vietnamese and explaining the purpose of the baits were distributed to any Vietnamese personnel working in a treated area.

Of the 550 rodents combed for ectoparasites, less than 2% harbored fleas, all of which were identified as the Oriental Rat flea (*Xenopsylla cheopis*). About 10% were found infested with various species of mites.

Lice. All three species of human lice are known from the Republic of Vietnam (RVN). Body and head lice (*Pediculus humanus*) were occasionally reported to the PMS but never confirmed. Crab louse (*Phthirus pubis*) infestations were not common and usually involved isolated cases that were easily controlled. The most memorable case began when an urgent message was

received by the Division Surgeon (with a copy to the Navy Surgeon General) in February, requesting immediate insecticide and dispersal equipment to control a "widespread body louse infestation in the bunker complexes" at Con Thien. The Tet offensive had just begun, the complex was under repeated attacks, and the PMS was not permitted to visit the area. Attempts to make direct contact by phone were unsuccessful. Due to the urgency of the message, 200 pounds of lindane and malathion dust and proper dusting equipment were dispatched to Con Thien. A few weeks later, it was learned that the situation had been blown out of proportion and involved only two individuals infested with crab lice.

Cockroaches. At least slight infestations of cockroaches could be found in most mess halls during sanitation surveys. With few exceptions, the species involved was the German Cockroach (*Blattella germanica*). On occasion, the American Cockroach (*Periplaneta americana*) was also found.

Termites. Except when termite nests were uncovered by personnel digging bunkers or tearing down old buildings, most complaint calls concerning these insects were received when swarms appeared during June and July. Termite damage could be found in most of the older buildings, which was not surprising since neither the lumber nor the ground was treated in the construction of these "temporary" structures.

Ants. During the summer months, complaints were commonly received concerning ant infestations in living quarters. Exposed food and drink were the usual attractant, and the practice of eating inside hootches was discouraged.

Stored Product Pests. Only three complaints were received concerning infestations of stored product pests. In two instances, hominy grits were involved and in the third, several sacks of flour. In all cases, the infestations consisted of the Red Flour Beetle (*Tribolium castaneum*) and the Saw-toothed Grain Beetle (*Oryzaephilus surinamensis*).

Blister Beetles. Meloid beetles were not common; however, several cases of contact dermatitis caused by a small staphylinid beetle (*Paederus* spp.) were encountered during the year. The vesicating fluid secreted by this insect produced lesions similar to those occasionally caused by DEET insect repellent. Lesions from the repellent were usually limited to the antecubital fossi, while those from the beetle could be found anywhere on the body and were usually "streak-like" in appearance.

Bed Bugs. Complaints of bed bugs were seldom received. A Vietnamese orphanage in Chu Lai was found heavily infested but nothing like it was ever encountered on marine cantonments. In one instance, bed bugs (*Cimex hemipterus*) were found in a military head where they were reportedly biting personnel on the legs while they sat. Proper control techniques were explained and a hand compressed sprayer with ready-mixed insecticide was provided to the responsible corpsman. It was learned later that the problem was simply resolved by pouring diesel fuel on the structure and burning it down.

Other Arthropods. The *Scolopendra* genus of centipede found in Vietnam is the large tropical variety that attains lengths of up to 16 inches. These were commonly encountered in bunkers and stacks of lumber and, while known

to inflict a painful bite, they were not considered deadly. While few cases of envenomization were reported during the year, an encounter with one in a dark bunker was a memorable experience for even the toughest marine.

Scorpions are common throughout RVN but no cases of envenomization were reported during the year. A few mess halls experienced heavy infestations of spiders but generally they were only a minor nuisance. The large tarantula-like spider of the genus *Felenocosmia* was occasionally encountered but no bites were reported.

Black Widow Spider (*Latrodectus mactans*) infestations were encountered in several bunkers at the Force Logistics Command (FLC). Presumably, they were imported with gear shipped from CONUS. The NSA Hospital admitted several patients during the year with apparent spider bites in which necrosis was prominent about the bite site. The species of the spider involved was unknown.

Snakes. Of the few snake bite cases reported, all were from nonpoisonous species or from the common and militantly defensive Bamboo Viper (*Trimeresurus* spp.). The Bamboo Viper has a hemotoxic venom that is only weakly toxic to humans, and its bite seldom involved more than localized swelling and pain.

A reptile case built by Public Works enabled the PMS to keep several live snakes on display. These were usually the common species of *Natrix* and Bamboo Vipers. In April, a 4 1/2-foot Vietnamese Rock Python (*Python molurus*) was given to the PMS by a SeaBee Unit (MCB-1). Subsisting on a rich and plentiful diet of rats, she increased her length to well over seven feet by the end of the year. "Pythias"

soon became famous in her own right, and it was not uncommon to find an audience of 20 or more personnel (including visiting VIP's) intently watching her kill and devour her victims. Many also nervously held her for pictures to send home. In only one instance did she mistake her handler's hand for a rat, causing some hurt pride but no physical damage. (Pythias was eventually donated to the Steinhart Aquarium in San Francisco).

The live snake and lizard collection and the arthropod and general insect collections that were on display did much to enhance public relations and increase understanding of the PMS and its mission. It also afforded an opportunity to "sell" preventive medicine and explain the functions and programs of the Section. This helped dispel the idea that PMS was just "the guys that chased bugs and inspected heads."

Summary of Lessons Learned

1. Personal protective measures become especially crucial when combat intensity and absence of definable combat fronts preclude use of ground and aerial dispersal.

2. For personal protective measures to be significantly effective requires a high usage rate of repellents and suppressive drugs, a low drug failure rate, continuing education, and aggressive monitoring of compliance.

3. Aerial spray operations fell short of expectations due to limited payload, the vastness of the areas needing treatment, a lack of pilots and aircraft, equipment malfunctions and hostile fire.

4. Operational research on new skin and clothing repellents and suppressive drugs needs priority emphasis.

5. Being under the technical control of the Division Surgeon but receiving all administrative and logistical support from the CO, 1st Medical Battalion, was at times unsatisfactory (e.g., this situation resulted in a lack of dedicated vehicles and drivers for eight months).

6. Initially, serious deficiencies in pest and vector control existed because combat units deployed without adequate supplies and equipment.

7. Aggressive and consistent command support is critical to the success of malaria discipline programs.

8. Basic training of medical department personnel in vector surveillance, vector control and malaria discipline should be done in CONUS, not in the combat theater.

9. Medical intelligence needs to be more current and accurate, especially for countries where we may be involved in future conflicts or in rendering humanitarian assistance.

10. Receiving contingency experience (e.g., disaster relief, humanitarian assistance) during peacetime would better prepare military entomologists for deployment to a combat zone.

11. Urgent requests that seem bizarre (e.g., "widespread body louse infestations in the bunker complexes" at Con Thien) often are, and the true nature of the problem needs to be determined or verified before drastic action is taken.

12. When immediate survival is threatened, concern about a malaria attack and proper use of personal protective measures is often a low priority.

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